Changes in water chemistry leave lake critters defenseless

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Imagine that the players on your favourite football team were smaller than their opponents, and had to play without helmets or pads. Left defenseless, they would become easy prey for other teams. Similarly, changes in Canadian lake water chemistry have left small water organisms vulnerable to their predators, which may pose a serious environmental threat, according to a new study.

"At low calcium levels the organisms grow slower and cannot build their armour," says study lead author Howard Riessen, professor of biology, SUNY College at Buffalo. "Without suitable armour, they are vulnerable to ambush by predators," he says.

Riessen and colleagues, including York University biology Professor Norman Yan, studied the effect of changes in water chemistry on plankton prey defenses. Specifically, they examined how lower calcium concentrations affect Daphnia (water flea) exoskeleton development. These low calcium levels are caused by loss of calcium from forest soils, a consequence of decades of acid rain and multiple cycles of logging and forest growth. The results are published this week in the Proceedings of the National Academy of Sciences.

"Calcium is a critical element for *Daphnia* and many other crustaceans," Riessen says. "*Daphnia* build their exoskeletons, which include some defensive spines, with calcium to protect themselves from predators. Where calcium levels are low, the *Daphnia* have softer, smaller, exoskeletons with fewer defensive spines, making them an easy snack."

Why do plankton matter? Yan, the study's senior author and a Fellow of the Royal Society of Canada, emphasizes that the tiny creatures are critical to our survival. "Without plankton, humans would be quite hungry, and perhaps even dead. Much of the world's photosynthesis, the basis of all of our food, comes from the ocean's plankton. The oxygen in every other breath we take is a product of phytoplankton photosynthesis," says Yan.

This phenomenon of reduced calcium is also playing out on a much larger scale in the world's oceans, he notes. "Increases in ocean acidity are complicating calcium acquisition by marine life, which is an under-reported effect of global carbon dioxide emissions. Thus marine plankton may also find themselves more vulnerable to predators," he says.

The public is used to stories about changes in water chemistry that lead to large-scale fish kills, says Riessen. "These changes are more insidious. *Daphnia* might not be a household name, but they are food for fish, and they help keep our lakes clean. Changing the balance between *Daphnia* and their predators marks a major change in lake systems."

Provided by York University

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